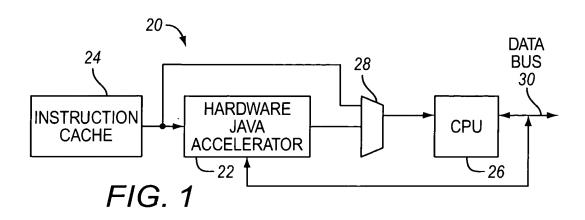
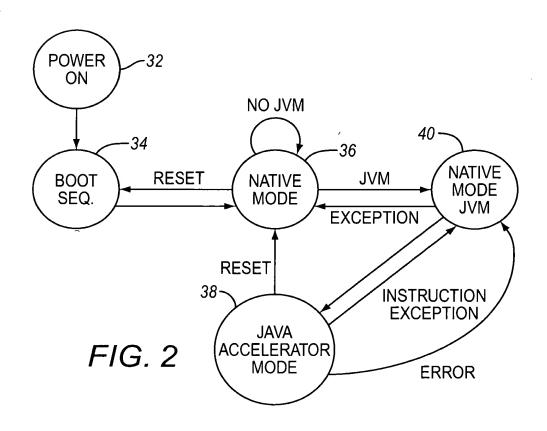


TITLE: JAVA HARDWARE ACCELERATOR USING

ODE ENGINE INVENTOR(S): PATEL

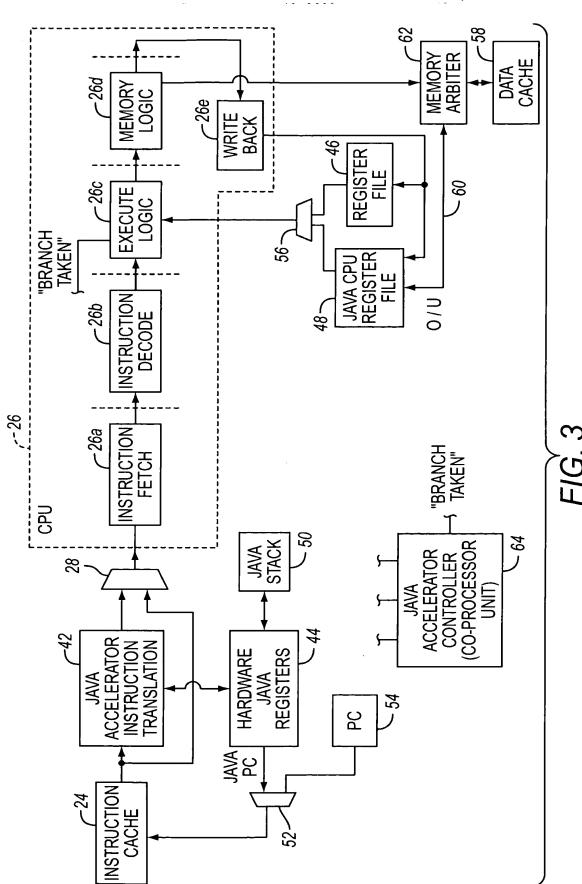
APPLICATION SERIAL No: 09/687,777 SHEET 1 of 19





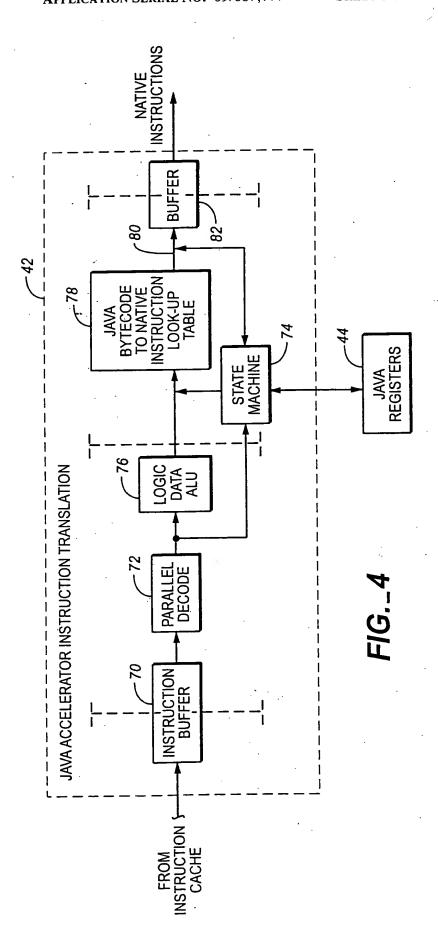
OIPE SCTO

APPLN. FILING DATE: OCTOBER 13, 2000
TITLE: JAVA HARDWARE ACCELERATOR USING MICRODE ENGINE
INVENTOR(S): PATEL
APPLICATION SERIAL NO: 09/687,777 SHEET 2 of 19





APPLN. FILING DATE: OCTOBER 13, 2000
TITLE: JAVA HARDWARE ACCELERATOR USING
MICROSODE ENGINE
INVENT. R(s): PATEL
APPLICATION SERIAL NO: 09/687,777
SHEET 3 of 19





MICROCODE ENGINE
INVENTORS): PATEL

Inventor(s): Patel Application Serial No: 09/687,777

SHEET 4 of 19

# I. INSTRUCTION TRANSLATION

JAVA BYTECODE

<>

NATIVE INSTRUCTION

iadd

ADD R1, R2

### II. JAVA REGISTER

PC = VALUE A
OPTOP = VALUE B
(R1)
VAR = VALUE C

了

PC = VALUE A + 1 OPTOP = VALUE B - 1 (R2)

VAR = VALUE C

## III. JAVA CPU REGISTER FILE

R0 0001

CONTAINS VALUE → R1 0150

OF TOP OF

OPERAND STACK

R2 1210

R3 0007

R4 0005

R5 0006

CONTAINS FIRST → R6 1221

VARIABLE

R7 1361

 $\Rightarrow$ 

NOT A VALID R0 0001 STACK VALUE → R1 0150 CONTAINS VALUE → R2 1360 OF THE TOP OF R3 0007

OPERAND STACK R4 0005 R5 0006

R6 1221

R7 1361

#### IV. MEMORY

OPTOP = VALUE B -> - 0150 (VALUE B - 1) - 1210 - 0007 - 0005 - 0006

<>

- 0150 OPTOP = VALUE B - 1 - 1360

- 0007

- 0007

- 0005

0006

- 0001

- 4427

VAR = VALUE C - 1221

1361

0001

4427

- 1101

VAR = VALUE C - 1221

- 1361

- 1101

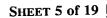


TITLE: JAVA HARDWARE ACCELERATOR USING

MICRO DE ENGINE

INVENTOR(S): PATEL

APPLICATION SERIAL NO: 09/687,777



# I. INSTRUCTION TRANSLATION

JAVA NATIVE BYTECODE INSTRUCTION

### II. JAVA REGISTER

PC = VALUE A PC = VALUE A + 2
OPTOP = VALUE B

(R1)

VAR = VALUE C

PC = VALUE A + 2
OPTOP = VALUE B

(R1)

VAR = VALUE C

### III. JAVA CPU REGISTER FILE

R0 0001 R0 0001 CONTAINS → R1 1371 CONTAINS → R1 0150 VALUE OF VALUE OF R2 1210 R2 1210 TOP OF TOP OF R3 0007 R3 0007 STACK **OPERAND STACK** R4 0005 R4 0005 R5 0006 R5 0006 -CONTAINS → R6 1221 CONTAINS FIRST → R6 1221 **VARIABLE FIRST** R7 1361 R7 1361 **VARIABLE** 

#### IV. MEMORY

1371 OPTOP = VALUE B OPTOP = VALUE B → 0150 1210 1210 0007 0007 0005 0005 0006 0006 0001 0001 4427 4427



APPLN. FILING DATE: OCTOBER 13, 2000
TITLE: JAVA HARDWARE ACCELERATOR USING MICROCO' ENGINE
INVENTOR(S): PATEL
APPLICATION SERIAL NO: 09/687,777 SHEET 6

**SHEET 6 of 19** 

Opcodes Mnemonic	Opcode xHH	Excep Gen
nop	0x00	
aconst_null	x01	
iconst m1	x02	
iconst_n(0-5)	x03 - x08	
lconst_n(0-1)	x09 - x0a	
fconst_n(0-2)	x0c - x0d	
dconst n(0-1)	x0e -x0f	
bipush	x10	
sipush	x11	
ldc	x12	у
ldc w	x13	У
ldc2_w	x14	у
iload	x15	
lload	x16	
fload	×17	<u> </u>
dload	x18	
aload	x19	
iload n(0-3)	x1a - x1d	
lload_n(0-3)	x1e - x21	
fload_n(0-3)	x22 - x25	
dload_n(0-3)	x26 - x29	
aload_n(0-3)	x2a - x2d	
iaload_ii(0-5)	x2e	
laload	x2f	
faload	x30	
daload	x31	
aaload	x32	<del></del>
baload	x33	
caload	x34	
saload	x35	
istore	x36	
Istore	x37	
	x38	
fstore	x39	
dstroe	x3a	
istore_n(0-3)	x3b - x3e	
Istore_n(0-3)	x3f - x42	
fstore_n(0-3)	x43 - x46	
dstore_n(0-3)	x47 - x4a	
astore_n(0-3)	x4b - x4e	
	x45 - x46	
lastore	x50	
lastore		
fastroe	x51	
dastore	x52	
bastore	x53	
aastore	x54	ļ
castroe	x55	<u> </u>
sastore	x56	<u> </u>

FIG.\_7A



TITLE: JAVA HARDWARE ACCELERATOR USING MICROCOLENGINE

MICROCOL ENGINE
INVENTOR(S). PATEL
APPLICATION SERIAL NO: 09/687,777

**SHEET 7 of 19** 

	x57	
pop	x58	
pop2		
dup	x59	
dup_x1	x5a	
dup_x2	x5b	
dup2	x5c	
dup2_x1	x5d	·
dup2_x2	x5e	
swap	x5f	
iadd	x60	
ladd	x61	
fadd	x62	у
dadd	x63	у
isub	x64	
Isub	x65	
fsub	x66	У
dsub	x67	у
imul	x68	
	x69	
Imul	x6a	У
fmul	x6b	У
dmul	x6c	
idiv		у
ldiv	x6d	у
fdiv	x6e	у
ddiv	x6f	у
irem	x70	. у
Irem	x71	У
frem	x72	У
drem	x73	У
ineg	x74	
Ineg	x75	
fneg	x76	У
dneg	x77	У
ishl	x78	
Ishl	x79	
ishr	x7a	
Ishr	x7b	
iushr	x7c	
lushr	x7d	
iand	x7e	
land	x7f	
ior	x80	
lor	x81	
ixor	x82	
Ixor	x83	
iinc	x84	
	x85	у
i2!	x86	y
i2f	x87	y
i2d	x88	
12i		У
12f	x89	У
12d	x8a	У

FIG.\_7B



MICROCOL ENGINE
INVENTOR(S. PATEL
APPLICATION SERIAL NO: 09/687,777



•		
121	x8b	у
[2]	x8c	уу
f2d	x8d	у
d2i	x8e	у.
d2l	x8f	У
d2f	x90	у
i2b	x91	
i2c .	x92	
i2s	x93	
Icmp	x94	у
fcmpl	x95	y.
	×96	y
fcmpg	x97	у
dcmpi	x98	y
dcmpg	x99	
ifeq	x9a	
me	x9b	
iflt	x9c	
ifge	x9d	
ifgt	x9e	
ifle	x9f	
if_icmpeq	xa0	
if_icmpne		
if_icmplt	xa1	
if_acmpge	xa2	
if_cmpgt	xa3	
if_icmple	xa4	
if_acmpeq	xa5	
if_acmpne	xa6	
goto	xa7	
jsr	xa8	
ret	xa9	
tableswitch	xaa	у
lookupswitch	xab	у
ireturn	. xac	
Iretum	xad	
freturn	xae	
dretum	xaf	
areturn	xb0	· · · · · · · · · · · · · · · · · · ·
return	xb1	
getstatic	xb2	у
putstatic	xb3	у
getfield	xb4	y
putfield	xb5	у
invokevirtual	xb6	у
invokespecial	xb7	у.
invokestatic	xb8	у
invokeinterface	xb9	у
xxunsedxxx	xba	У
new	xbb	У
пеwаптау	xbc	У
апеwаптау	xbd	У
arraylength	xbe	у



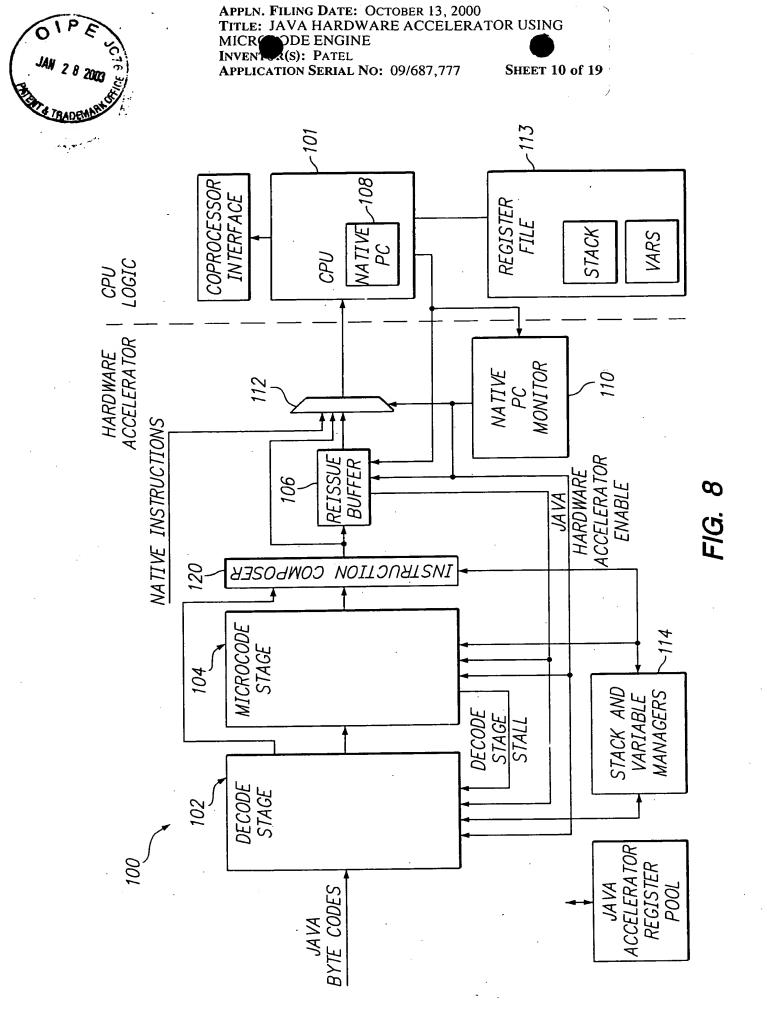
MICROCE E ENGINE
INVENTORS): PATEL
APPLICATION SERIAL NO: 09/687,777



**SHEET 9 of 19** 

athrow.	xbf	у
checkcast	XCO	ý
instanceof	xc1	ý
monitorenter	xc2	у
monitorexit	xc3	y
wide	xc4	y
multianewarray	xc5	y
ifnull	xc6	y
ifnonnull	- xc7	y
goto_w	xc8	<del>                                     </del>
	xc9	
jsr_w		
	- vob	
ldc_quick	xcb	у
ldc_w_quick	xcc	у
ldc2_w_quick	xcd	У
getfield_quick	xce	у
putfield_quick	xcf	у
getfield2_quick	xd0	у
putfield2_quick	xd1	У
getstatic_quick	xd2	У
putstatic_quick	xd3	<u>y</u>
gtestatic2_quick	xd4	<u>y</u>
putstatic2_quick	xd5	у
invokevirtual_quick	xd6	<u>y</u>
invokenonvirtual_quick	xd7	у у
invokesuper_quick	xd8	у
invokestatic_quick	xd9	у
invokeinterface_quick	xda	у
invokevirtualobject_quick	xdb	У
new_quick	xdc	у
anewarray_quick	xde	У
multinewarray_quick	xdf	У
checkcast_quick	xe0	у
instanceof_quick	xe1	У
invokevirtual_quick_w	xe2	У
getfield_quick_w	xe3	У
putfield_quick_w	xe4	у
breakpoint	xca	У
impdep1	xfe	У
impdep2	xff	у

FIG.\_7D

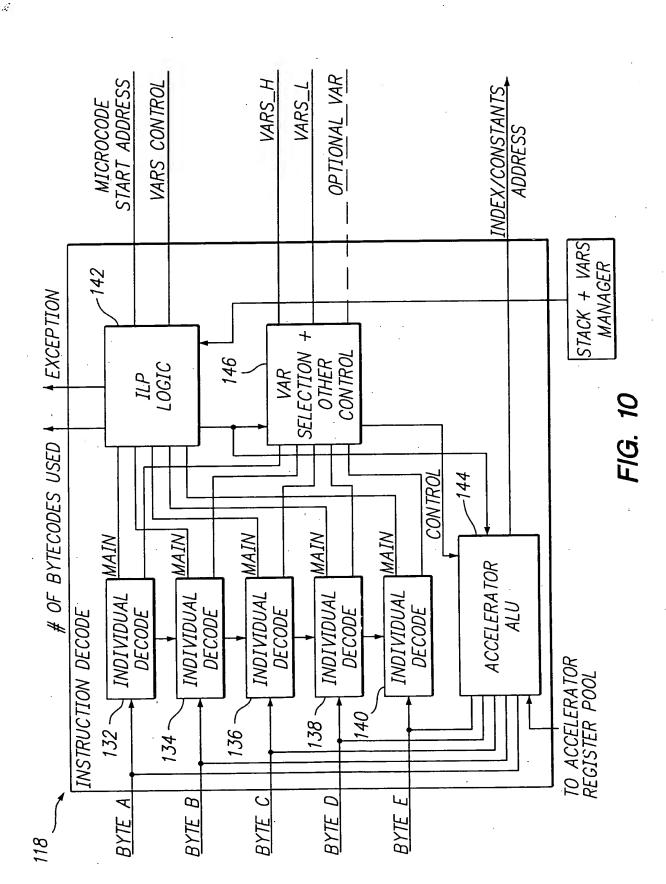


APPLN. FILING DATE: OCTOBER 13, 2000 TITLE: JAVA HARDWARE ACCELERATOR USING MICE CODE ENGINE Inventor(s): Patel Application Serial No: 09/687,777 **SHEET 11 of 19** TO MICROCODE 130c INDEX/ADDRESS INSTRUCTION START ADDRESS VARS CONTROL MICROCODE DECODE FIG. BYT PREFETCH STAGE BUFFER/ ALIGNMENT JAVA PROGRAM COUNTER BYTECODE BUFFER CONTROL BYTECODE 120 PREFETCH STAGE ADDRESS UNIT *DECODE* STAGE

PE ENGINE

Inventors): Patel Application Serial No: 09/687,777

**SHEET 12 of 19** 





APPLN. FILING DATE: OCTOBER 13, 2000 TITLE: JAVA HARDWARE ACCELERATOR USING MICROCOLE ENGINE Inventor Patel Application Serial No: 09/687,777

**SHEET 13 of 19** 

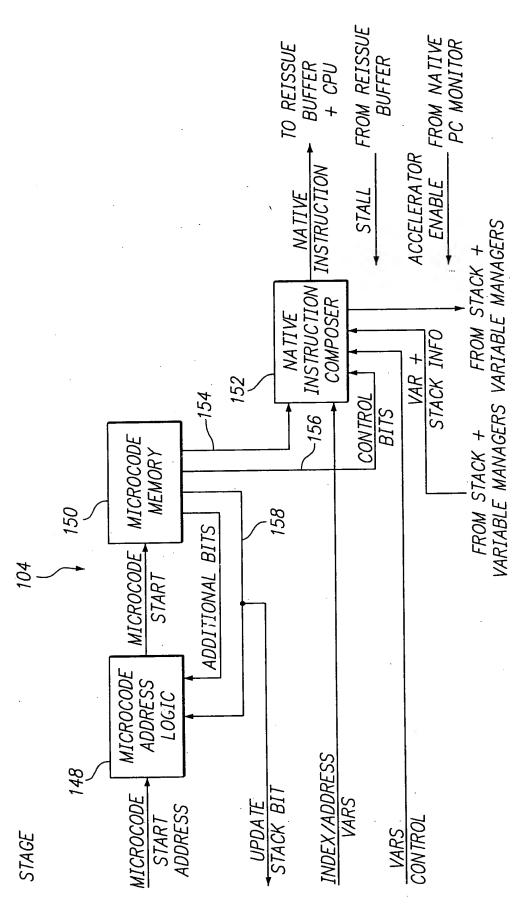


FIG. 11



APPLN. FILING DATE: OCTOBER 13, 2000
TITLE: JAVA HARDWARE ACCELERATOR USING MICROSODE ENGINE
INVENTORS): PATEL

APPLICATION SERIAL NO: 09/687,777

SHEET 14 of 19

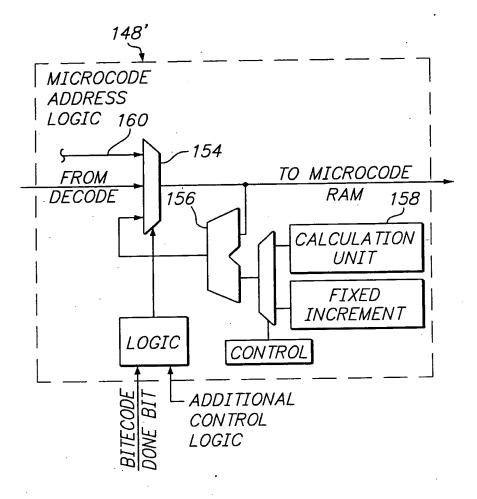
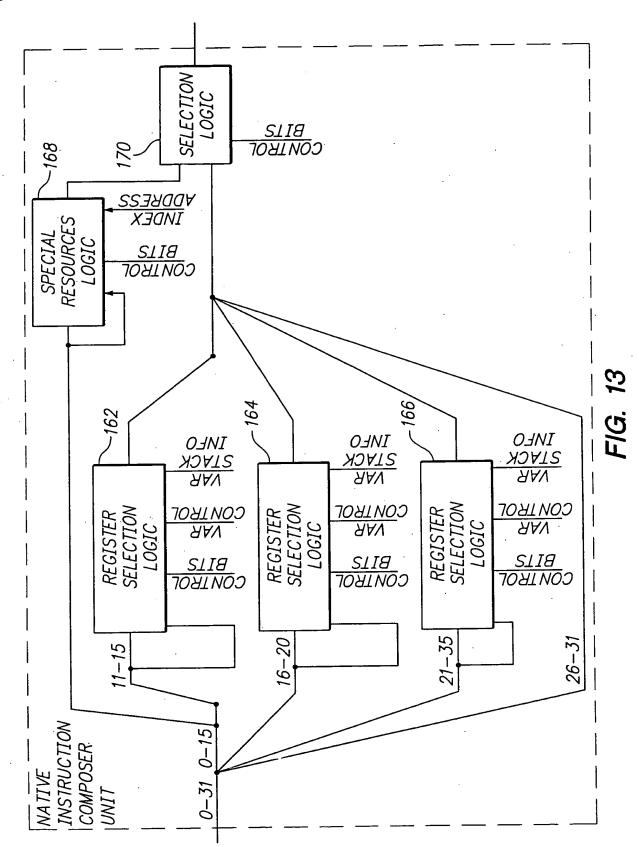


FIG. 12

MICROSODE ENGINE Invent (s): Patel Application Serial No: 09/687,777

**SHEET 15 of 19** 



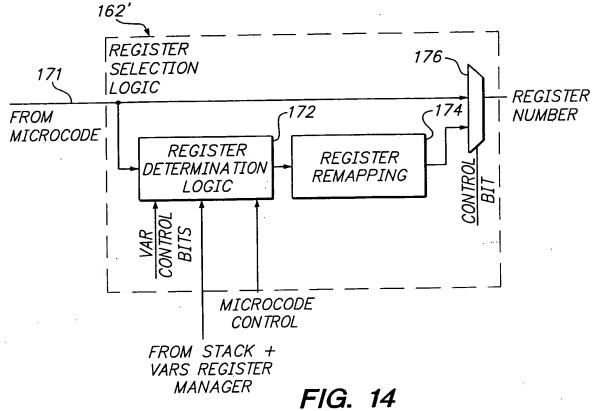


TITLE: JAVA HARDWARE ACCELERATOR USING

MICROCOPE ENGINE
INVENTO : PATEL

APPLICATION SERIAL NO: 09/687,777

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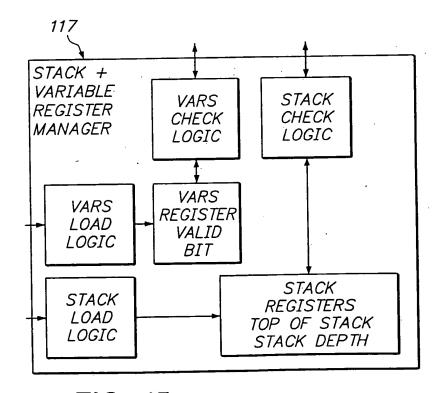
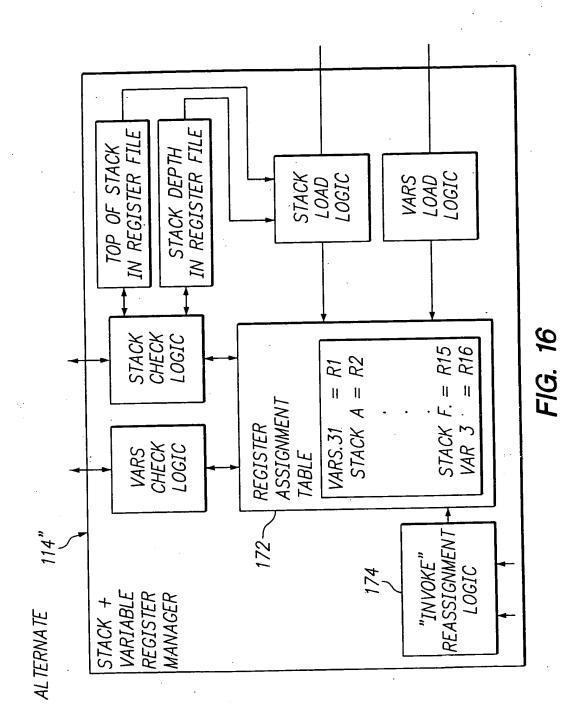


FIG. 15



MICROS DE ENGINE
INVENTOS: PATEL
APPLICATION SERIAL NO: 09/687,777

**SHEET 17 of 19** 



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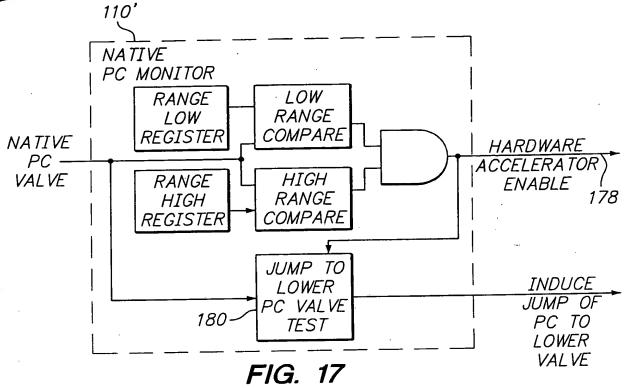
APPLN. FILING DATE: OCTOBER 13, 2000

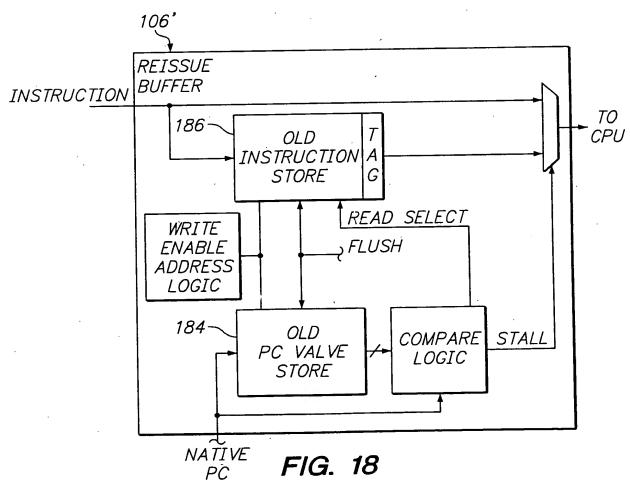
TITLE: JAVA HARDWARE ACCELERATOR USING

MICROCODE ENGINE
INVENTO :: PATEL

APPLICATION SERIAL NO: 09/687,777

**SHEET 18 of 19** 







ENTOR(S, ATEL PLICATION SERIAL NO: 09/687,777 **SHEET 19 of 19** 

LOAD VAR BASE STORED IN STACK MANAGE INTO TEMP REGISTER R1

VAR 31 FROM DO LOAD OF

<u>TEST</u> NO

TYPE COMBINATION

iload 31 -- L

8

istore jadd

MEMORY

TOS MODIFICATION=1+1 VAR\_H CONTROL=01 VAR\_L CONTROL=01 OP TYPE=iadd /ARS\_L=5 COMBINATION VARS\_ 97 BYTECODE A -- iload 3 B - iload 5 C - iadd

BYTECODE BYTECODE BYTECODE

PUT RESULT INTO THE TOP

OF THE STACK

LOAD WORD R1 + 31(x4)

F/G. 20

BYTECODES USED=3